

## Fall 2011 Syllabus for Geol452/552 – Geographic Information Systems for Geoscientists I

Geol 452/552 (same as Agron 452, EnSci 452)

Instructor: Chris Harding ([charding@iastate.edu](mailto:charding@iastate.edu))

Time: Tuesdays/Thursdays 9:00 to 9:50, lab from 10:00 to 10:50

Credits: 3 (2 hrs lecture, 2 hrs lab)

Prerequisites: some geoscience background (such as geology, water resources, environmental science, soil science or related earth and life sciences).

Place: Rm. 248 in Durham Center

Teaching assistant: Rachel Lishansky ([rlishans@iastate.edu](mailto:rlishans@iastate.edu))

Office Hours: by appointment, send email first

### Course description

GIS for Geoscientists I is an introduction to GIS operations and analyses of vector data in a geoscience context and will prepare students for more advanced GIS courses (such as its follow-up course, GIS for Geoscientists II, which deals with raster data). We will use ESRI's ArcGIS 9.3 Desktop software application. This hands-on course will be taught at a senior undergraduate (400) level; students taking the course at the graduate (500) level will also work on additional exercises and projects. The 500-level version of the course, which includes a class project, counts as part of the "Foundations of GIS" requirements for the College of Design's GIS certificate.

### Course objectives:

This course will help you to acquire basic GIS theory and practical knowledge. It will allow you to work with geo-spatial data in the form of computerized 2-D maps and the spatial attributes behind them. At the conclusion of the course you should be able to:

- Develop an understanding of typical GIS operations as part of GIS project management.
- Understand the architecture of ESRI's ArcGIS program, its historical development and its main data types.
- To classify and visualize vector data (points, lines, polygons), raster data and table data within different layers using colors, symbols and labels.
- Be able to use the most common coordinate systems (geographic and projected) and understand the different distortions inherent in map projections.
- Be able to import simple text files and manipulate non-spatial data tables, perform simple statistics and create relationships across tables (join/relate).
- Use the Structured Query Language (SQL) to find data with certain attributes and select data based on location and spatial relationships to other data.
- Create new compound data based on common spatial relationships (spatial join)
- Use map overlay processing to locate areas fitting multiple spatial criteria and perform data clipping and buffering.
- Create maps that effectively present spatial data.
- Be able to interactively edit (digitize) the shape of vector data and manipulate its underlying attributes.
- For graduate students: create a compelling poster on a topic of your choice that could be presented at a conference.

**Required texts:** Mastering ArcGIS, 5. **Edition from 2011(!)**, by Maribeth H. Price, 978-0077462956, 610 pages, spiral-bound with Video Clips on CD-ROM, McGraw Hill Higher Education.

Check [www.isubookstore.com](http://www.isubookstore.com) -> Order Textbooks

### Course Structure:

Twice a week, there will be a lecture in the first hour followed by a 5 min break and one hour of practical lab exercises on the computers. Before each lecture I will provide you with a paper printout of the class' power point slides - this will include sufficient space for your notes. Prior to the lecture, I expect that you have read the relevant part of the textbook and that you can

answer the review questions. I will go over some of these review questions during the lecture. During most lectures we will practice using ArcGIS in small “follow along” exercises. We will go over ten of the textbook’s 15 chapters. Each chapter’s practical work consists of a tutorial part (“Mastering the skills”) and a set of practical (lab) exercises. You should be able to get through the tutorials and exercises during the 1 hour lab following the lecture but you may need to finish them on your own time. The GIS lab opening hours are posted on the door to Rm. 248 or here <http://www.it.iastate.edu/labsdb/viewlab.php?id=202>, note that there are other classes in 248 during the week.

### **Expectations of students:**

I expect you to participate in class and take responsibility for your learning. Your attendance in class provides you with the very important opportunity to ask questions! Ordinarily, no “make-ups” will be provided for exams missed due to absence from class. If you are going to miss a class, you need to let me know several days in advance. I expect you to treat the instructor and other students with respect (be on time, turn off cell phones, don’t talk with classmates during lectures, don’t read the newspaper during class, etc.).

I realize that sitting in front of a computer during my lecture may tempt you into all kinds of online activities. While I understand the importance of checking your email and maintaining your Facebook page, please limit any non-course activity to the breaks. I strongly suggest that **you write notes about the material during the lecture into the handout and/or the textbook!** Those notes will be needed for the open book exams later and may could turn out to be very valuable when you need to remember how to solve a certain ArcGIS problem for you research or as part of your GIS job!

### **Practical (lab) exercises (“Homework”):**

Several textbook exercises from each chapter will be graded as *homework* (HW) assignments (typically worth 3 points each). For example, I may require you to work on exercises 1, 2, and 7 of a certain chapter. Each chapter’s practical contains a step-by-step tutorial that prepares you for the textbook exercises. Although the book has some questions for you to answer the tutorials will NOT be graded. It is up to you to go over the tutorial as needed; if you get stuck, ask us for assistance or watch that step on the video. The tutorial will give you the skills needed for the homework exercises and mini project, however, you can skip them if you think you have these skills already.

For each HW assignment (which will be graded) you will create a Word (.doc) file containing the solution, a short description of how you found the solution, and several screenshots. (Paste the screenshots directly into the work document). This will be submitted into Blackboard (as an attachment). The end of the text book contains a “sort-of” solution that, while not sufficiently detailed can point you into the right direction if you’re stuck.

The number of points given depends largely on how well you can describe your solution in text and screenshots. A “good” description that covers all major points and is clear to follow is worth 3 points. A “very good” description that presents additional aspects, is worth and extra 1 point; 2 points are given for work with minor flaws; and work with major flaws is worth 1 point. Example: 27 miles may be the correct answer but you won’t get more than 1 point for that, for 3 points you also need to describe how you got that answer.

Each HW will usually contain around mandatory 3 exercises and 1-2 “extra” exercises. These extra exercises are **optional for 452 students**, but are **mandatory for 552 students**.

You should be able to get through the tutorial and the exercises during the lab hour directly after the lecture. During these lab hours, the TA and I will be available for questions about the assignments or tutorials – I suggest you take advantage of this! It’s OK to form an ad hoc group with the students sitting next to you during the lab and work with them - as long as the results you hand in describes **your own** work. Exercises you do not finish during the lab phase will have to be completed outside the lab period, you typically have one week. You can use ArcGIS in a different GIS lab (e.g. the Geology lab in Science I), it is also possible to get a ArcGIS student version for your personal PC (ask me).

You need to hand in your homework via Blackboard, don't email them to the TA on me (unless Blackboard is down)! Exercises handed in too late will be penalized - some exceptions apply, including instructor and/or Blackboard screw-ups or any absence you OK'ed with me (conferences, etc.). If you got through all this so far, email me with code 1789 during the first week to get an additional point for your first HW exercise.

### **Midterm exam and Final exam:**

Both exams will consist of a multiple-choice question part (answer 12 of 15 questions in 15 minutes, open book) and a practical part (90 min., of which I expect you need only 60 min.) where you will use ArcGIS to analyze and process GIS data given to you (similar to the practical exercises in the book). Both will test the entire material presented to this point!

### **GIS projects:**

Mini-projects: In addition to the book's tutorial and exercises we will work on 2-3 larger, non textbook exercises that will deal with bigger chunks of material. For these "mini-projects" the relevant data and a list of questions will be given to you, the deliverables are one or more simple maps that show your answer these questions. We will go through the material together in class and you will have a week to hand in the project.

Class-project: A larger, final project is mandatory for *graduate students* (those taking Geol 552). The topic is up you but should, if possible, involve your graduate/thesis work. The final project will require a short proposal, stating the purpose of the project, the target audience as well as the data and GIS methods to be used. The actual project work will include: the acquisition of suitable data (from ISU databases or other sources), the preparation of data to suit the ArcGIS software package, computational work with and analysis of the data and presentation of your results. The final project's deliverables are: a poster (that shows good layout), plus a 10 min. oral presentation of the results to the class. You will create 10 power point slides from the poster for the oral presentation. Clarity of presentation and content will be graded equally. The final project is optional for undergrads and will count as extra credit.

### **Class participation:**

Your class participation score will be based on attendance and participation during class. I will give you a "participation point" every time you give me good feedback (via Bb's feedback forum) about the material presented in class: what you see as today's take-away message, something you did absolutely not understand and why this was a problem ("Today's muddiest point") or the single most important point you learned today (the clearest point you took away from today's class). I'll also reward an intelligent question about the day's material and a short (1 paragraph summary of the lecture). As a rule of thumb I expect you to post at least 5 feedback posts over the course of the semester but more are welcome. Note that you can post anonymously on the lecture feedback forum on Blackboard but you don't have to if you don't mind that other students can read your feedback. If you

### **Blackboard Learn:**

We'll be using Blackboard Learn (or Bb) (<https://bb.its.iastate.edu>) for some aspects of the course, please familiarize yourself with Bb if you've never used it before. You can find an updated version of this syllabus on Bb. Each session's plan will be listed as announcements before the lecture starts. You will hand-in your homework assignments via Bb's "assignments" functions. Test dates and assignment due dates for will show up on your Bb calendar. WebCT's journal-type discussion function (which is private between student and instructor) allows you to give me direct feedback such as best-of-lecture, worst-of-lecture, questions, etc. If you run into problems, please email the TA or me first before you contact the official Bb help.

### **Grading:**

All grading will be in percent (0%-100%), that I will convert to letter grades for the final grade according to this scale: A: >95%, A-: > 90%, B+: >85%, B: > 80%, B-: > %75%, etc.

Undergrads: Homework 30%, mini-projects %15, Midterm 20%, Final 25%, Participation 10%.  
Extra credit: for extra HW and a class project

Grads: Homework 20%, mini-projects %10, Final project 20%, Midterm 20%, Final 20%, Participation 10%.

### **Course files (GIS data, HW, projects)**

We will use the GIS center's Delphi server, which is administered by Robin McNeely (4-2087, mobes@iastate.edu, www.gis.iastate.edu). Course data files are stored at \\delphi.gis.iastate.edu\GEOL552\data . Note that anything stored on the GIS-lab computer's C: drive will be deleted when you log out, **do NOT use the C: drive to store permanent data** (such as your project data). As of Fall 2011, ISU has given each student a free personal 5 Gb Cyfiles folder (<http://www.it.iastate.edu/services/storage/cyfiles>). On ISU PCs (incl. the GIS lab) this personal cyfiles folder is mapped to the U: drive.

**I strongly suggest that you create a folder in U:\ called ArcGIS (U:\ArcGIS) now and that you put all of your GIS related files into this ArcGIS folder.** If you do not have a U: drive, you can use a personal folder

under [\\delphi.gis.iastate.edu\GEOL552\students\yourNetID](http://delphi.gis.iastate.edu/GEOL552/students/yourNetID) instead. A bonus point awaits you if you email me code 1848 within the first week. I have already copied the tutorials and exercises from the textbook's CD and put them on the server's [\\delphi.gis.iastate.edu\GEOL552\data\mgisdata](http://delphi.gis.iastate.edu/GEOL552\data/mgisdata) folder, please copy this mgisdata folder into "your" personal folder before you start using the textbook. During the semester I will provide more GIS data for "follow along" exercises during the lecture and for the miniprojects, you will need to copy this data from the GEOL552\data folder to your Delphi student folder first (use ArcCatalog).

To watch the video help for the textbook's tutorials load the file *Playing the MGIS video clips.htm* (inside [\\delphi\geol552\data](http://delphi/geol552/data)) in a browser, you can play a video for each of the tutorial steps from the book by clicking on its number. *To listen to the video in the GIS lab, you need to bring your own headphones!*

### **Supplemental texts:**

Designing Better Maps - A Guide for GIS Users (ESRI, 2005) Cynthia A. Brewer, 220 pages, ISBN: 1-58948-089-9, \$24.95. Written by a cartographer, this book focuses on the effective design of maps: what colors are the best for what kind of data, layout, fonts, symbols, etc. Highly recommended!

Cartography: Thematic Map Design, (Slocum et al.), Fifth Edition, Borden D. Dent, Boston: WCB McGraw-Hill, 1999). The ESRI Guide to GIS Analysis Volume 1: Geographic Patterns & Relationships, Paperback: 186 pages, ISBN: 1879102064, ~\$20

The ESRI Guide to GIS Analysis, Volume 2: Spatial Measurements and Statistics, ISBN: 1-58948-116-X, 2005, 252 pages, \$34.95

**Non-Discrimination Policy:** Iowa State University is "dedicated to fostering an environment in which differences in people such as nationality, race, gender, religion, cultural background, physical ability, and sexual orientation, are respected and mutual understanding is promoted." (from the ISU Bulletin)

**Disability Accommodation:** Any student who feels s/he may need an accommodation based on the impact of a disability should contact me privately to discuss your specific needs. Please contact the Disability Resources Office at 515-294-6624 in room 1070 Student Services Building to coordinate reasonable accommodations for students with documented disabilities.

### **Academic Dishonesty**

I expect students to follow the ISU rules regarding Academic Dishonesty (see [www.iastate.edu/~catalog/2007-2009/geninfo/dishonesty.html](http://www.iastate.edu/~catalog/2007-2009/geninfo/dishonesty.html)).

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